CLAIMS

We claim:

1. A monitor substrate for measuring an ion-implantation ion energy and dosage comprising:

   a thin film supported on said monitor substrate wherein said thin film having an optical characteristic that is sensitive to said ion-implantation damage as described by implant dose and implant energy.

2. The substrate of claim 1 wherein:

   said thin film having a reflectivity that is sensitive to said ion-implantation damage.

3. The substrate of claim 1 wherein:

   said thin film comprising a mixture of dye molecules with weak covalent bonds sensitive to said ion-implantation energy and dosage in a polymer matrix suitable for wafer-coating.

4. The substrate of claim 3 wherein:

   said mixture of a dye with a weak covalent bond having a heterogeneous-cleavage property that is sensitive to said ion-implantation energy and dosage.

5. The substrate of claim 4 wherein:

   said dye mixture has an optical property of changing from transparent to colored upon heterogenious-cleavage.

6. The substrate of claim 1 wherein:

said monitor substrate is a silicon substrate, which may have a thin oxide coating.

7. The substrate of claim 1 wherein:

said thin film having a thickness ranging substantially from one micrometer to twenty micrometers.

8. An apparatus for measuring an ion-implantation dosage comprising:

a scanning densitometer for measuring reflected light from a monitor substrate; and

a thin film supported on said monitor substrate wherein said thin film having an optical characteristic that is sensitive to said ion-implantation.

9. The apparatus of claim 8 further comprising:

a light source for projecting measuring beam onto said monitor substrate for generating a reflected light.

10. The apparatus of claim 9 further comprising:

a bare silicon substrate for measuring a full scale reflected light represented by I_0 reflected from said bare silicon substrate with said light source projecting a full scale light onto said bare silicon substrate.

11. The apparatus of claim 10 further comprising:

a light source control means for controlling said light source to project said full scale light onto a plurality of points on said monitor substrate before and after an ion implantation for obtaining reflectances I′ and I″ respectively at each point.

12. The apparatus of claim 10 further comprising:

an ion-implantation measurement controller for controlling said apparatus and for calculating said implantation ion energies and dosage from said reflected light from said monitor substrate.

13. The apparatus of claim 8 wherein:

said thin film having a reflectivity that is sensitive to said ion-implantation ion energy and dosage.

14. The apparatus of claim 8 wherein:

said thin film comprising a mixture of a dye with a weak covalent bond that is sensitive to said ion-implantation damage and a polymer matrix suitable for wafer-coating.

15. The apparatus of claim 10 wherein:

said mixture of a dye with a weak covalent bond having a heterogeneous-cleavage property that is sensitive to said ion-implantation ion energy and dosage.

16. The apparatus of claim 8 wherein:

said monitor substrate is a silicon substrate.

17. The apparatus of claim 8 wherein:
said monitor substrate is a silicon substrate with a thin oxide coating of 50 to 5000 angstroms.

18. The apparatus of claim 8 wherein:

said thin film having a thickness ranging substantially from a micrometer to twenty micrometers.

19. A method for measuring an ion-implantation ion energy and/or dosage comprising:

a) measuring a full scale reflection, represented by I_o, by projecting a full scale light onto a bare silicon;

b) performing a pre-implant reflection measurement by projecting said full scale light onto a plurality of points on a monitor substrate having a thin film supported on said monitor substrate with said thin film having an optical characteristic that is sensitive to said ion-implantation-dosage producing optical intensities I'; and

c) performing an ion implantation and then performing a post-implant reflection measurement by projecting said full scale light onto said plurality of points on said monitor substrate to obtain a set of reflection intensities, I'', for each of said points on said monitor substrate for calculating an ion-implantation energy and/or dosage profile.

20. The method of claim 19 wherein:

said step c) of obtaining a set of reflection intensity differences for each of said plurality of point on said monitor substrate is a step of calculating a logarithmic value for a ratio of I′, a reflection intensity before, and I″, a reflection intensity after said step of ion implantation.

21. The method of claim 19 wherein:
said step c) of obtaining a set of reflection intensity differences for each of said plurality of point on said monitor substrate is a step of calculating a ratio of a reflection intensities before and after said step of ion implantation.

22. The method of claim 19 wherein:

said step c) of obtaining a set of reflection intensity differences for each of said plurality of point on said monitor substrate is a step of calculating the arithmetic differences between reflection intensities before and after said step of ion implantation.

23. A method for measuring an ion-implantation energy and/or dosage comprising:

a) forming a thin film with an optical characteristic sensitive to an ion-implantation dosage; and

b) measuring a change of said optical characteristic after an ion implantation for calculating said ion implantation energy and/or dosage.